

“Custody of Digital Records: Options and Implementation Considerations”

**Prepared for the
South Carolina Department of Archives and History
By
Gregory S. Hunter, Ph.D., CA, CRM
Hunter Information Management Services, Inc.
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Introduction.....	1
The OAIS Reference Model	2
Custody Options.....	4
Custodial Digital Archives.....	6
Non-Custodial Digital Archives	7
Co-Custodial Digital Archives.....	7
Summary	8
Implementation Considerations	9
Costs.....	9
Personnel.....	13
Three-Year Plan	14
Conclusion	15

Introduction

The South Carolina Department of Archives and History received an electronic records grant from the National Historical Publications and Records Commission (NHPRC). The final phase of the project involved an analysis of options for custody of digital records. Hunter Information Management Services, Inc. is pleased to assist with this part of the project.

South Carolina’s situation is similar to that of many state archives. Only one state, Washington, has a truly comprehensive digital archives program including state-of-the-art facilities. The other states have implemented various parts of a digital archives program, such as: electronic records policies, media-neutral retention schedules, specialized staff, secure storage, preservation planning, and authorized access. All state archives know that much remains to be done.

The basic framework for any digital archives is the OAIS Reference Model, which was developed by the scientific community and has become an international standard. Therefore, this report will begin with a brief review of the components of the OAIS Reference Model applicable to the subject of custody. Next, the report will discuss the

three options for custody. Finally, the report will present considerations in implementing the three custodial options.

The OAIS Reference Model

The “Reference Model for an Open Archival Information System (OAIS)” was developed by the Consultative Committee for Space Data Systems and issued in 2002.¹ The Committee defined an OAIS as “an archive[s], consisting of an organization of people and systems, that has accepted the responsibility to preserve information and make it available for a Designated Community.”

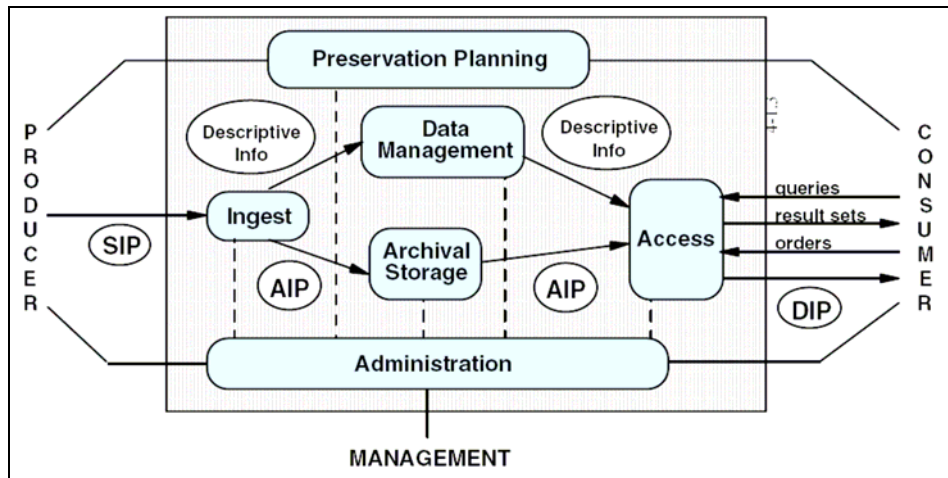
The elements of this definition can serve as a framework for planning by the South Carolina Department of Archives and History:

- *An organization of people and systems.* While a digital archives must have information systems to manage digital records, it also must have the people, policies, and procedures necessary for long-term stewardship of the records.
- *That has accepted responsibility.* A digital archives does not happen by accident; it is not a collection of backup tapes that manage to survive. Rather, an agency must make a commitment to a digital archives – a commitment that will require ongoing support.
- *To preserve information.* Since the beginning of time, archives have preserved records of long-term value. With digital records, new preservation challenges arise from the fragility of physical media and the obsolescence of hardware and software.
- *And make it available.* Especially in the public archives tradition, preservation is not an end in itself. Rather, records are preserved so they can be used. In the digital realm, future access will face the same challenges of hardware and software obsolescence.
- *For a designated community.* The OAIS was developed for the space community, an important but narrow constituency. The “designated community” of the South Carolina Department of Archives and History, however, is much broader: government officials, the general public, the press – anyone with a right to and interest in the records.

Implementing the OAIS framework involves six functional areas and related interfaces as summarized in the following diagram prepared by the CCSDS:²

¹ Available at <http://public.ccsds.org/publications/archive/650x0b1.pdf>

² This information begins on page 4-1 of the document



The six functional areas are as follows:

1. *Ingest* provides the services and functions to accept Submission Information Packages (SIPs) from Producers and prepare the contents for storage and management within the archives.
2. *Archival Storage* provides the services and functions for the storage, maintenance and retrieval of Archival Information Packages (AIPs).
3. *Data Management* provides the services and functions for populating, maintaining, and accessing both Descriptive Information and administrative data used to manage the archives.
4. *Administration* provides the services and functions for the overall operation of the archives system. It also provides system engineering functions to monitor and improve archives operations, and to inventory, report on, and migrate/update the contents of the archives.
5. *Preservation Planning* monitors the environment of the OAIS and provides recommendations to ensure that the information stored in the OAIS remains accessible to the Designated User Community over the long term, even if the original computing environment becomes obsolete.
6. *Access* supports Consumers in determining the existence, description, location and availability of information stored in the OAIS, and allows Consumers to request and receive information products.

In addition to the six areas described above, there are various *Common Services* that include security and communications.

Taking this one step further, there are specific archival activities associated with each OAIS area. The following table summaries the archival activities:

OAIS Area	Archival Activities
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Ingest	Receive records Perform quality assurance on received records Establish an authenticity baseline Extract descriptive information
Archival Storage	Add records to permanent storage Manage the storage hierarchy Refresh and replace storage media Perform routine and special error checking Provide disaster prevention and recovery
Data Management	Administer the archives database/catalog Perform database updates Perform queries on the database Produce reports from these result sets
Administration	Solicit and negotiate submission agreements with Producers Audit submissions to ensure that they meet archives standards Maintain configuration management of system hardware and software.
Preservation Planning	Evaluate the contents of the archives Recommend migration of archives holdings Develop recommendations for standards and policies Monitor changes in the technology environment and in the Designated Community's requirements
Access	Communicate with Consumers to receive requests Apply controls to limit access to specially-protected information Coordinate the execution of requests to successful completion Generate responses (Dissemination Information Packages, result sets, reports) Deliver the responses to Consumers

Taken as a whole, the OAIS Reference Model is comprehensive but also intimidating. My purpose in summarizing the model is not to discourage the South Carolina Department of Archives and History with all that must be done. Rather, my purpose is to emphasize that steps taken now to establish a digital archives must be part of a larger plan to guarantee our digital legacy for future generations. The first step, however, must be taken before the legacy can be secured.

Custody Options

One of the important first steps in any digital archives is determining who will maintain custody of the records. The *Glossary* of the Society of American Archivists (SAA)³ defines custody as “care and control, especially for security and preservation; guardianship.” In archival practice there are two kinds of custody:

³ Available at <http://www.archivists.org/glossary/index.asp>

- *Physical custody*, which is defined as “possession, care, and control, especially for security and preservation.”
- *Legal custody*, which is defined as “the ownership and the responsibility for creating policy governing access to materials, regardless of their physical location.”

In the pre-digital world, both physical and legal custody usually were transferred to an archives. The archives would take possession of the paper along with legal responsibility for its administration, serving as a trusted, third-party repository for our recorded memory.

With digital archives, however, even established thinking about custody is open to reconsideration. In the last three decades there have been two approaches to custody:

- *Custodial digital archives.* The U.S. National Archives and Records Administration (NARA) has been the world leader in taking both physical and legal custody of digital records.
- *Non-custodial digital archives.* The National Archives of Australia has pioneered the strategy of leaving digital archives in the custody of their originating agencies.

Below I will discuss the relevance of each of these approaches for the South Carolina Department of Archives and History. I also will discuss a third approach that I have recommended to several institutions, “co-custodial digital archives.” In this third approach, the archival institution takes legal custody but partners with another agency to maintain physical custody.

The South Carolina Department of Archives and History has a number of activities that it must address early in the development of a digital archives. Among these are:

- *Solicit and negotiate submission agreements with producers.* Based upon approved retention schedules, both parties agree upon records to be transferred and the timing for the transfer.
- *Receive records.* The archives receives the records, either on physical media or through electronic transfer.
- *Audit submissions to ensure that they meet archives standards.* The archives needs to make certain that it received the records it was supposed to receive in a format that it can process.
- *Perform quality assurance on received records.* The records must be reviewed for completeness. The records also must be scanned for viruses and other malware.

- *Establish an authenticity baseline.* The archives should apply an “integrity seal,” commonly in the form of a hash algorithm, so it can identify any changes to be bitstream (either intentional or accidental).
- *Extract descriptive information.* Some descriptive information likely can be extracted automatically from system metadata (date of creation, author, etc.) while other descriptive information will need to be entered manually by the archivist.
- *Add records to permanent storage.* The records and their descriptive information, including their integrity seal, will need to be moved to managed archival storage.
- *Perform routine and special error checking.* From the very beginning, archival storage will need to be monitored so there is no loss of integrity of the digital records.
- *Provide disaster prevention and recovery.* Similarly, the digital archives must be protected from natural and human disasters by storing backups at a suitable distance from the original.
- *Administer the archives database/catalog.* Information collected about the records needs to be organized and managed.

I believe that other activities outlined in the OAIS Reference Model can be a lower priority for South Carolina.

- In some cases (preservation formats, migration strategies, etc.), there are national and international efforts at solutions. By waiting, South Carolina can benefit from the considerable investments of others.
- In other cases (refreshing and replacement of physical media, configuration management of the system, etc.), activities will need to be addressed in the future as the archival system moves through its own lifecycle.
- Finally, activities surrounding access and use can be deferred until records are under archival custody.

In the final section of this report, I will discuss implementation considerations for each of the three custodial options.

Custodial Digital Archives

The traditional way for archives to maintain the integrity of records is to transfer both physical and legal custody from the creating agency. With paper records, archivists sometimes overlook the fact that two different “custodies” are being transferred. The exception is a “deposit agreement,” whereby an archives takes physical custody but legal custody remains with the creator.

With digital records, it is possible – and even desirable – to separate the two transfers of custody. One scenario might be:

- The originating agency transfers digital records
- The archives receives the records and validates that they are correct, complete, and free of viruses. Any problems with the transfer are corrected at this point.
- The originating agency and the archives document the transfer of physical custody.
- The archives applies an integrity seal and moves the records to managed archival storage.
- Legal custody can be transferred at this point or at any time in the future.

The Custodial Digital Archives is modeled on traditional archival practice, including the archives' assumption of all costs upon transfer of custody.

Non-Custodial Digital Archives

SAA defines non-custodial records as “archival records, usually in electronic format, that are held by the agency of origin, rather than being transferred to the archives.”

The idea [is] that archivists will no longer physically acquire and maintain records, but that they will provide management oversight for records that will remain in the custody of the record creators.... The postcustodial theory shifts the role of the archivists from a custodian of inactive records in a centralized repository to the role of a manager of records that are distributed in the offices where the records are created and used.

In a Non-Custodial Digital Archives, the archival agency establishes policies and procedures and audits originating agencies for compliance. The argument is that the originating agency is better able to maintain the information infrastructure necessary to read its digital records over time. In this model, the originating agency retains physical and legal custody – as well as the costs associated with both.

Policies, procedures, and compliance audits are key aspects of any records program. However, with digital records I believe more is required. I am concerned that budget pressures will keep originating agencies from fulfilling their custodial obligations toward inactive business records. I recommend that a Non-Custodial Digital Archives be the choice of last resort.

Co-Custodial Digital Archives

The concept of a “Co-Custodial Digital Archives” is one of my own creation. In this model the archives takes legal custody but transfers responsibility for physical custody to a third-party with an expertise in information systems. The third party might be:

- A state agency with centralized IT responsibility
- A state university campus or system
- A private-sector firm specializing in storage of digital records
- Another archives at the federal, state, or local level

The arrangement between the archives and the physical custodian must be documented in a memorandum of understanding detailing service levels and fees for services. The best developed state-level digital archives, in Washington State, uses such memoranda for both state agencies and local governments.⁴

A co-custodial solution has the following advantages for an archives:

- Ability to match services with available budget
- Avoidance of ongoing system replacement responsibility and cost
- Ability to scale storage capacity as volume increases
- Ability to acquire expertise as needed without increasing full-time staff

An archives should focus on what it does uniquely well, especially in an era of limited resources. In the case of microfilming, this often involves a focus on preservation microfilm rather than the filming of temporary records (which can be handled equally well by others). With digital records, an archives may decide that a long-term commitment to physical custody is outside of its area of expertise.

Summary

As a way of summarizing the custodial options, it is convenient to relate them to the major components of the OAIS Reference Model:

OAIS Component	Custodial Archives	Non-Custodial Archives	Co-Custodial Archives
Ingest	Transfer of legal and physical custody to archives	No transfer of legal or physical custody. Descriptive information may be transferred	Transfer of legal custody to archives and physical custody to third party
Archival Storage	Responsibility of archives	Responsibility of originating agency	Responsibility of third party
Data Management	Responsibility shared between archives and	Responsibility of originating agency	Archives responsible for policy; third party

⁴ Washington State uses a custodial option. Even legal custody of local government records is transferred to the State Archives. See <http://www.digitalarchives.wa.gov/staticcontent/Feasibility%20Study.pdf>. The National Archives and Records Administration is using a co-custodial approach though they refer to it as “pre-accessioning.” NARA has taken physical custody of some electronic records (such as the records of the military governor in Iraq) years before NARA will take legal custody. NARA’s purpose is to initiate preservation and assure authenticity.

	third party		responsible for implementation
Administration	Responsibility shared between archives and third party	Responsibility of originating agency	Archives responsible for policy; third party responsible for implementation
Preservation Planning	Responsibility shared between archives and third party	Responsibility of originating agency	Archives responsible for policy; third party responsible for implementation
Access	Responsibility shared between archives and third party	Responsibility of originating agency	Archives responsible for policy; third party responsible for implementation

There is one additional point to keep in mind. Decisions about custody can, and perhaps even should, change over time. For example, it is reasonable for an archives to begin with a co-custodial approach and move toward a custodial approach as its own staff and budget permit. Since our understanding of digital preservation is evolving, a flexible approach is highly desirable.

Implementation Considerations

Implementing a digital archives involves many considerations. In this section I will focus on two of the more important, costs and personnel. I then will present a three-year implementation plan for the South Carolina Department of Archives and History.

Costs

In the last few years, there have been a number of studies of the costs of digital preservation. I have summarized the major studies below:

Study	Summary
Chapman (2003) ⁵	The Harvard University Library and the Online Computer Library Center, Inc. (OCLC) each manage centralized repositories optimized for long-term storage of library collections. Both organizations fully recover operational expenses by charging owners annual rates for managed storage services, regardless of materials use. The Harvard Depository assesses rates for analog storage per billable square foot. The OCLC Digital Archive assesses rates per gigabyte for storage of digital objects. Formats are

⁵ Chapman, Stephen. "Counting the Costs of Digital Preservation: Is Repository Storage Affordable?" *Journal of Digital Information*, Volume 4 Issue 2. 2003. Available at <http://jodi.tamu.edu/Articles/v04/i02/Chapman/>.

	significant, but not sole factors in determining preservation costs in these models. Owners' definitions of content integrity and tolerance for risk, which can change over time, are also important variables in the complex equation of preservation costs and affordability.
Crespo and Garcia-Molina (2001) ⁶	Designing an archival repository is a complex task because there are many alternative configurations, each with different reliability levels and costs. This paper studied the costs involved in an Archival Repository and introduced a design framework for evaluating alternatives and choosing the best configuration in terms of reliability and cost.
ERPA (2003) ⁷	This article presented a tool to provide a better picture of the cost aspects of digital preservation. It does not provide calculation methods (or formulas). Every organization will have to identify its own needs that will be dependent on the business context.
Granger, Russell, and Weinberger (2000) ⁸	This document identified some of the main costs elements that institutions can expect to encounter when considering digital preservation as part of their ongoing collection management function. It is divided into two parts: parts: an introduction and overview of some of the general issues associated with digital preservation, and an examination of the costs of digital preservation.
Hendley (1998) ⁹	This study provides a methodology for analyzing several categories of costs: creation; selection and evaluation (acquisition); data management; resource disclosure; data use; data preservation; and rights management.
Lavoie (2004) ¹⁰	Technical issues are only one aspect of sustainable preservation activities. Ultimately, these technical processes must be coordinated with the economic process of marshaling and organizing sufficient resources to achieve preservation objectives. In this regard, preservation in the twenty-first century will represent a significant departure from traditional practice. From an economic perspective, preservation will be redefined in three areas: responsibilities, incentives, and organization.

⁶ Crespo, Arturo, Hector Garcia-Molina. "Cost-Driven Design for Archival Repositories." Joint Conference on Digital Libraries 2001 (JCDL'01); June 24-28, 2001; Roanoke, Virginia, USA. Available at <http://www-db.stanford.edu/~crespo/publications/cost.pdf>.

⁷ "ERPA Guidance: Cost Orientation Tool." 2003. Available at <http://www.erpanet.org/guidance/docs/ERPANETCostingTool.pdf>.

⁸ Granger, Stewart, Kelly Russell, and Ellis Weinberger: "Cost elements of Digital Preservation (version 4)." October 2000. Available at <http://www.leeds.ac.uk/cedars/colman/costElementsOfDP.doc>.

⁹ Hendley, Tony. "Comparison of Methods & Costs of Digital Preservation." *British Library Research and Innovation Report 106*; 1998. Available at <http://www.ukoln.ac.uk/services/elib/papers/tavistock/hendley/hendley.html>.

Lavoie (2003) ¹¹	Economic issues are a principal component of the research agenda for digital preservation. Economics is fundamentally about incentives, so a study of the economics of digital preservation should begin with an examination of the incentives to preserve. Securing the long-term viability and accessibility of digital materials requires an appropriate allocation of incentives among key decision-makers in the digital preservation process. But the circumstances under which digital preservation takes place often lead to a misalignment of preservation objectives and incentives. Identifying circumstances where insufficient incentives to preserve are likely to prevail, and how this can be remedied, are necessary first steps in developing economically sustainable digital preservation activities.
Oltmans (2004) ¹²	This PowerPoint presentation provided cost models for migration and emulation approaches to digital preservation.
Oltmans and Kol (2005) ¹³	This paper discussed life cycle management issues as they relate to two prominent digital preservation techniques and associated costs: migration and emulation. It argued that applying the emulation strategy may be more efficient in terms of life cycle management (and thus costs) than the migration strategy.
Palm ¹⁴	This article presented a detailed analysis of costs for digitizing and long-term storage at the Riksarkivet (National Archives, RA) in Stockholm, Sweden. The model for the estimation of costs has a wider relevance and can be used to make similar calculations in other situations.
DPC ¹⁵	The DCC/DPC joint Workshop on Cost Models for preserving digital assets was held at the British Library. Seventy delegates from the UK, Europe, and the US discussed costs and business models with a number of key themes emerging.
Sanett (2003) ¹⁶	This paper explored issues of cost modeling and proposed a

¹⁰ Lavoie, Brian. "Of Mice and Memory: Economically Sustainable Preservation for the Twenty-first Century." Found in *Access in the Future Tense*. CLIR; 2004. Pg. 45-54.
<http://www.clir.org/pubs/reports/pub126/pub126.pdf>.

¹¹ Lavoie, Brian. "The Incentives to Preserve Digital Materials: Roles, Scenarios, and Economic Decision-Making." OCLC Office of Research; 2003. Available at
<http://www.oclc.org/research/projects/digipres/incentives-dp.pdf>.

¹² Oltmans, Erik. "Cost Models in Digital Archiving." Presentation at LIBER 2004, Life Cycle Collection Management, St. Petersburg, July 1, 2004. Available at <http://www.enssib.fr/divers/liber2004/Oltmans.pdf>.

¹³ Oltmans, Erik, and Nanda Kol. "A Comparison Between Migration and Emulation in Terms of Costs." *RLG Diginews* Volume 9, Number 2; 2005. Available at
http://www.rlg.org/en/page.php?Page_ID=20571#article0.

¹⁴ Palm, Jonas. "The Digital Black Hole." Riksarkivet/National Archives Sweden. Available at
http://www.tape-online.net/docs/Palm_Black_Hole.pdf.

¹⁵ "Report for the DCC/DPC Workshop on Cost Models for Preserving Digital Assets." Available at
<http://www.dpconline.org/graphics/events/050726workshop.html>.

	cost framework that included three categories: (1) Costs for Preserving Electronic Records, which include capital costs, direct operating costs, and indirect operating costs; (2) Costs for Use, which are costs associated with the continued institutional use of the preserved records; and (3) User Populations, which provides information relating to access and use of the records.
Sanett (2002) ¹⁷	Financial management tools can support the decision-making processes in archives when preserving electronic records. Applying business concepts, in combination with archival precepts and collection management principles, to the challenge of preserving electronic records will assist institutions in making decisions that will support their mission statements and act in the best interests of their users. This article proposed that a cost model specific to preserving authentic electronic records be developed.

Taken as a whole, these articles make several points important for the South Carolina Department of Archives and History:

- The willingness to bear the costs of digital preservation is related to the centrality of preservation to the mission of the institution.
- The cost of managing the bits is but a small percentage of overall costs.
- Digital preservation involves both capital and operating costs. The relationship of these major categories varies according to the preservation strategy being implemented.
- Cost models and formulas still are being developed and validated.

The bottom line is that there is no magic plug-in formula for projecting costs of digital preservation. This is even more the case with the co-custodial approach, which is still relatively new in the preservation community.

During the next year, I recommend that the South Carolina Department of Archives and History work with the Office of the State CIO, a state university, or other willing partner to develop a cost schedule for the digital preservation activities included in the OAIS Reference Model.

¹⁶ Sanett, Shelby. "The Cost to Preserve Authentic Electronic Records in Perpetuity: Comparing Costs across Cost Models and Cost Frameworks." *RLG Diginews*, August 15, 2003, Volume 7, Number 4. Available at http://www.rlg.org/legacy/preserv/diginews/v7_n4_feature2.html.

¹⁷ Sanett, Shelby. "Toward Developing a Framework of Cost Elements for Preserving Authentic Electronic Records into Perpetuity." *College and Research Libraries* 63 (5):388-404. 2002. Available at <http://www.ala.org/ala/acrl/acrlpubs/crljournal/backissues2002b/september02/sanett.pdf>.

The first step would be to establish some free “archival test space” on the CIO servers to develop baseline statistics. The purpose of this test space is to experiment with options for such things as:

- Transfer (on-line, physical media)
- Intensity of maintenance (simple storage vs. various levels of monitoring)
- Speed of disaster recovery (on-line, near-line, off-line)
- Format conversion (from proprietary to standard formats)
- Access (specialized viewers vs. standard Web interface)

The South Carolina Department of Archives and History should be commended for beginning experimentation and testing with its existing resources. The Archives is working with the Judicial Department and has transferred digital Supreme Court Case Files. However, the Archives can only go so far without additional resources.

After 6-12 months of working with the Office of the State CIO, it should be possible to negotiate costs for a production environment. The costs and any metrics used to gather them in the experimental environment would be of great interest to the worldwide preservation community.

Because of this wider interest, the development of costs and metrics would be an excellent grant-funded project. The purpose of the project would be to take one or more components of a digital archives program and develop comparative costs for in-house vs. outsourced solutions. For example, all aspects of transfer and ingest for several accessions (including the application of integrity seals and the extraction of metadata) would be performed by the State Archives and the Office of the State CIO. Worksheets would be used to identify and document all costs (staff, equipment, etc.) The result would be baseline metrics useful for other archives as well.

In the meantime, the South Carolina Department of Archives and History needs a baseline budget for digital preservation. Whatever the first-year baseline, I estimate that it will need to double in year 2 and double again in year 3. Therefore, at a minimum, I suggest the following three-year budget increases for digital preservation:

- Year 1: \$ 50,000
- Year 2: \$100,000
- Year 3: \$200,000

The division between capital and operating expenses will depend upon the choice of custody strategy.

Personnel

There is a concern across the entire archival profession about finding enough people with the specific skills necessary to implement digital preservation. For example, SAA and NARA recently co-sponsored a seminar on the topic of new skills for the digital age.

In the short-term (the next fiscal year), the South Carolina Department of Archives and History appears appropriately staffed to experiment with custodial options. In the second year the Archives will need to add at least one staff member:

- If the Archives opts for a custodial approach, the additional person(s) will need to have the technical skills necessary for the transfer and ingest of digital records.
- If the Archives opts for a co-custodial approach, the additional person(s) will be working with agencies and the custodial repository to build the holdings of the digital archives. The skillset will include an understanding of records and the ability to communicate with a variety of stakeholders.

With either approach to custody, I would anticipate adding at least one staff member in year three to focus on making the digital records available. This person will need to know archival descriptive standards and the design of databases.

Three-Year Plan

Painting with a broad brush, priorities for the next three years should be:

- Year 1: Refine custodial options and develop cost models.
- Year 2: Institute regular transfer of digital records from agencies.
- Year 3: Begin providing public access to the digital archives.

More detailed suggestions are presented below:

Element	Year 1	Year 2	Year 3
Personnel	Existing staff is sufficient. Training and professional development should continue	Add at least 1 staff member for transfer and ingest	Add at least 1 staff member for description and access
Telecommunications	Upgrade local environment to support transfer of digital collections between the Archives and the physical custodian	Establish regular on-line transfers from agencies directly to the physical custodian	Provide public access to the digital archives
Custody	Establish a co-custodial relationship with a third party. Conduct pilot transfers of records.	Expand transfers. Gather information on full costs of co-custodial digital archives	Revisit co-custodial decision and either reaffirm it or switch to a custodial approach

Costs	Establish costs for preservation services through the State CIO	Develop a long-term plan for capital purchases	Continue to refine cost models and begin providing sustainable funding for operating costs
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Conclusion

The South Carolina Department of Archives and History is at a key moment in its history. Unless the Archives takes action soon, key parts of the State's digital heritage will be lost forever. There is no choice but to establish a regular, ongoing, and sustainable digital preservation program. Working closely with the various stakeholder communities offers the best opportunity for establishing a successful program that stands the test of time.